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AN EVALUATION OF THE STATUS OF FISH POPULATIONS AND HABITAT IN THE NORTH FORK OF THE COEUR D'ALENE DRAINAGE

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Abstract

An average of six westslope cutthroat trout *Oncorhynchus clarki lewisi* were counted per transect in the Little North Fork, North Fork of the Coeur d'Alene and Tepee Creek drainages in 1991 compared to 4.8 in 1973, 4.1 in 1980, and 4.8 during 1981. In the reach of the North Fork where limited harvest of cutthroat trout was allowed (one cutthroat trout over 14" since 1988), an average of 7.5 cutthroat trout were counted in 1991 versus 2.4 in 1973, 0.5 in 1980, and 0.9 during 1981. In the reach with special regulations, between Yellowdog and Tepee creeks, an average of 11.2 cutthroat trout were counted per transect in 1973 (10 trout limit), 6.8 during 1980, 5.7 in 1981 (three trout, 13" minimum) and increased to 28.4 in 1991 (catch-and-release implemented in 1985). In the North Fork upstream from Tepee Creek, an average of six fish were counted in 1973, 5.8 in 1980, 5.4 during 1981, but only 1.1 in 1991. No cutthroat trout were observed in the transects in Tepee Creek during 1973, however an average of 1.3 were counted in 1980, 3.8 during 1981, and 2.8 in 1991. In the Little North Fork of the Coeur d'Alene River, an average of 5.6 cutthroat trout were counted per transect in 1973 (10 trout limit), 5.9 during 1980, 7.5 in 1981 (special regulations applied) and 3.9 in 1991 (one cutthroat trout, 14"minimum downstream of Laverne Creek; catch-and-release upstream of Laverne Creek since 1988).

We estimated that there were 13,005 (68/km) westslope cutthroat trout in the North Fork and Little North Fork of the Coeur d'Alene rivers and the Tepee Creek drainage during August 1991. Of the 13,005 fish, 87% were in the North Fork of the Coeur d'Alene River, and 6.5% each in the Little North Fork and Tepee Creek drainages. Of the estimated 11,365 fish in the North Fork about half were in the reach with limited harvest regulations and half in the section where no harvest was allowed. Of the estimated 5,018 fish in the section where harvest was not allowed, 87% were in the reach from Yellowdog to Tepee creeks and only 13% between Tepee and Cow creeks.

We estimated 108 cutthroat trout/km in the lower North Fork (Enaville to Yellowdog Creek; one cutthroat trout over 14" since 1988). Estimated cutthroat trout densities during 1990, for similar reaches of other rivers with regulations that allow harvest were 75/km in the St. Joe River (one cutthroat trout over 14" in effect since 1988); 30/km for the Little North Fork of the Coeur d'Alene River; 15/km in the Lochsa (six fish limit, only two over 16"; implemented in 1977) and 12/km for the North Fork of the Clearwater (three fish limit, no size limit; implemented in 1972) rivers.

We estimated there were 231 cutthroat trout/km in the lower end of the reach of the North Fork of the Coeur d'Alene River with regulations prohibiting harvest (Yellowdog to Tepee creeks). Similar densities were estimated for the lower ends of reaches of the St. Joe and Lochsa rivers with regulations not allowing harvest, only

70/km were estimated for lower Kelly Creek and 38/km for the Little North Fork of the Coeur d'Alene River. In the upper reach of the North Fork with catch-and-release regulations (Tepee to Cow creeks), we estimated 22 cutthroat trout/km, twice that for the analogous reach in the Little North Fork; but the estimated density for a similar reach of the St. Joe River was 345/km, 151 /km for the upper Lochsa River, and 178/km for upper Kelly Creek.

Runs were the predominant habitat type in most reaches of the study area ranging between 42 and 70%. Generally, runs were followed in descending order by riffles (13-49%), pools (9-32%), and chutes (0-4%). The proportions of pool and run habitat types in the reach of the North Fork between Tepee and Cow creeks and in Trail Creek were lower than in drainages without roads and extensively logged areas. Upper reaches of the Little North Fork had between one-half and one-third the pools, and slightly more runs, than Independence Creek, but the cause of the differences has not been determined.

Introduction

The purposes of this investigation were: (1) to collect fish density information in the North Fork of the Coeur d'Alene drainage for comparison with data from previous years, (2) to calculate a population estimate of westslope cutthroat trout *Oncorhynchus clarki lewisi* in the North Fork of the Coeur d'Alene drainage for comparison with estimates for the St. Joe, Lochsa, North Fork of the Clearwater and Kelly Creek drainages, (3) to compare proportions of habitat types between various reaches of the North Fork of the Coeur d'Alene drainage.

Improved access increased angling pressure and caused the abundance of westslope cutthroat trout stocks to decline in many northern Idaho streams by the 1960's (Ball 1971). To reduce angler caused mortality of cutthroat trout and provide a "quality" fishery, the Idaho Department of Fish and Game began revising angling regulations in 1970 to include reduced bag limits, minimum size limits, and catch-and-release regulations. Responses to the regulation changes were increased catch rates, and an increase in abundance of all size classes of cutthroat trout in the upper St. Joe and Kelly Creek drainages (Johnson and Bjornn 1978).

Bowler (1974) concluded over-exploitation had reduced cutthroat trout populations to a remnant status in the Coeur d'Alene River and recommended more restrictive angling regulations. Special regulations were subsequently implemented on the upper portion of the Coeur d'Alene River in 1975 (Table 1). However, cutthroat trout densities remained low in 1981 and were not responding as was observed in Kelly Creek or the upper St. Joe River (Lewynsky 1986).

Fishery managers believe poor habitat conditions may be the reason cutthroat trout populations in the Coeur d'Alene drainage have not responded to restrictive regulations like populations in other watersheds with similar regulations. Surveys in 1991 and 1992 by the U.S. Forest Service have documented a significant loss in pool and pocketwater habitat and a decrease in channel stability in drainages that have been logged and roaded compared to undeveloped watersheds (David Cross, Forest Fish Biologist, Panhandle National Forest, personal communication).

Fish populations in the North Fork of the Coeur d'Alene drainage have not been surveyed since 1981. Fish density information collected in 1991 provides the opportunity to re-evaluate fish populations after the implementation of catch-and-release regulations and to compare fish populations between watersheds that have been roaded and logged with those that are largely undeveloped.

Table 1. Summary of fishing regulations on the North Fork of the Coeur d'Alene and the Little North Fork of the Coeur d'Alene rivers.

	Little North Fork of Coeur d'Alene River		North Fork of Coeur'Alene River	
Year	Downstream of Laverne Creek	Upstream of Laverne Creek	Downstream of Yellowdog Creek	Upstream of Yellowdog Creek
Pre 1973	15 trout, no size limit		15 trout, no size limit	
1973-74	10 trout, no size limit		10 trout, no size limit	
1975	10 trout no size limit	3 trout 13" minimum	10 trout no size limit	3 trout 13" minimum
1976	10 trout 5 over 12" 2 over 18"	3 trout 13" minimum	10 trout 5 over 12" 2 over 18"	3 trout 13" minimum
1977-84	6 fish 2 over 16"	3 trout 13" minimum	6 fish 2 over 16"	3 trout 13" minimum
1985-87	6 fish 2 over 16"	3 trout 13" minimum	6 fish 2 over 16"	catch-and-release
1988-89	6 fish 2 over 16" only 1 cutthroat trout and must be over 14"	catch-and-release	6 fish 2 over 16" only 1 cutthroat trout and must be over 14"	catch-and-release
1990-93	6 fish only 1 cutthroat trout and must be over 14"	catch-and-release	6 fish only 1 cutthroat trout and must be over 14"	catch-and-release

Study Area

The Coeur d'Alene River originates on the Pend Oreille divide near the Montana border and flows southwesterly for approximately 190 km until entering Coeur d'Alene Lake. The study area was about 130 km long extending from Horse Haven landing field in the Little North Fork and Cow Creek in the North Fork downstream to the confluence with the South Fork (Figure 1). The study area is within the Panhandle National Forest and roads parallel major streams with the exception of the upper reaches of the North Fork and Independence Creek (sections four, five and 11 respectively; Figure 1).

Discharge of the North Fork of the Coeur d'Alene River, recorded at a gauging station immediately upstream from the South Fork, averaged 1,904 c.f.s. between 1939 and 1990 (U.S. Geological Surveys 1990). Peak flows have occurred between November and March in five of the ten years during the 1970's and 1980's and each year since 1990. Peak flows of 61,000 and 26,400 c.f.s. were recorded during January, in 1974 and 1990, respectively.

The current angling regulations in the North Fork and Little North Fork of the Coeur d'Alene rivers are catch-and-release upstream of Yellowdog and Laverne creeks (Table 1, Figure 1). Downstream from those tributaries, the daily harvest limit is six fish; only one may be a cutthroat trout which must be at least 14 inches (356 mm) in length.

Westslope cutthroat trout, sculpins *Cottus* spp. and speckled dace *Rhinicthys osculus* were observed throughout the study area. Rainbow trout *Oncorhynchus mykiss,* brook trout *Salvelinus fontinalis,* mountain whitefish *Prosopium williamsoni,* longnose suckers *Catostomus catostomus* and northern squawfish *Ptychocheilus oregonensis* were observed only in the lower half of the drainage.

Brook and rainbow trout are not indigenous to the Coeur d'Alene drainage. Brook trout were deliberately introduced in the region in the early 1900's but their abundance is sparse. Rainbow trout have been stocked in the river for decades but stocking was discontinued in the special regulation zone after 1974.

Methods

Abundance

Fish were counted from 1-27 August 1991, in the same snorkeling transects used by Bowler (1974) and Lewynsky (1986) to provide data comparable with that of previous years. Each previous survey collected fish density data during August. Westslope cutthroat, rainbow and brook trout were enumerated in 50

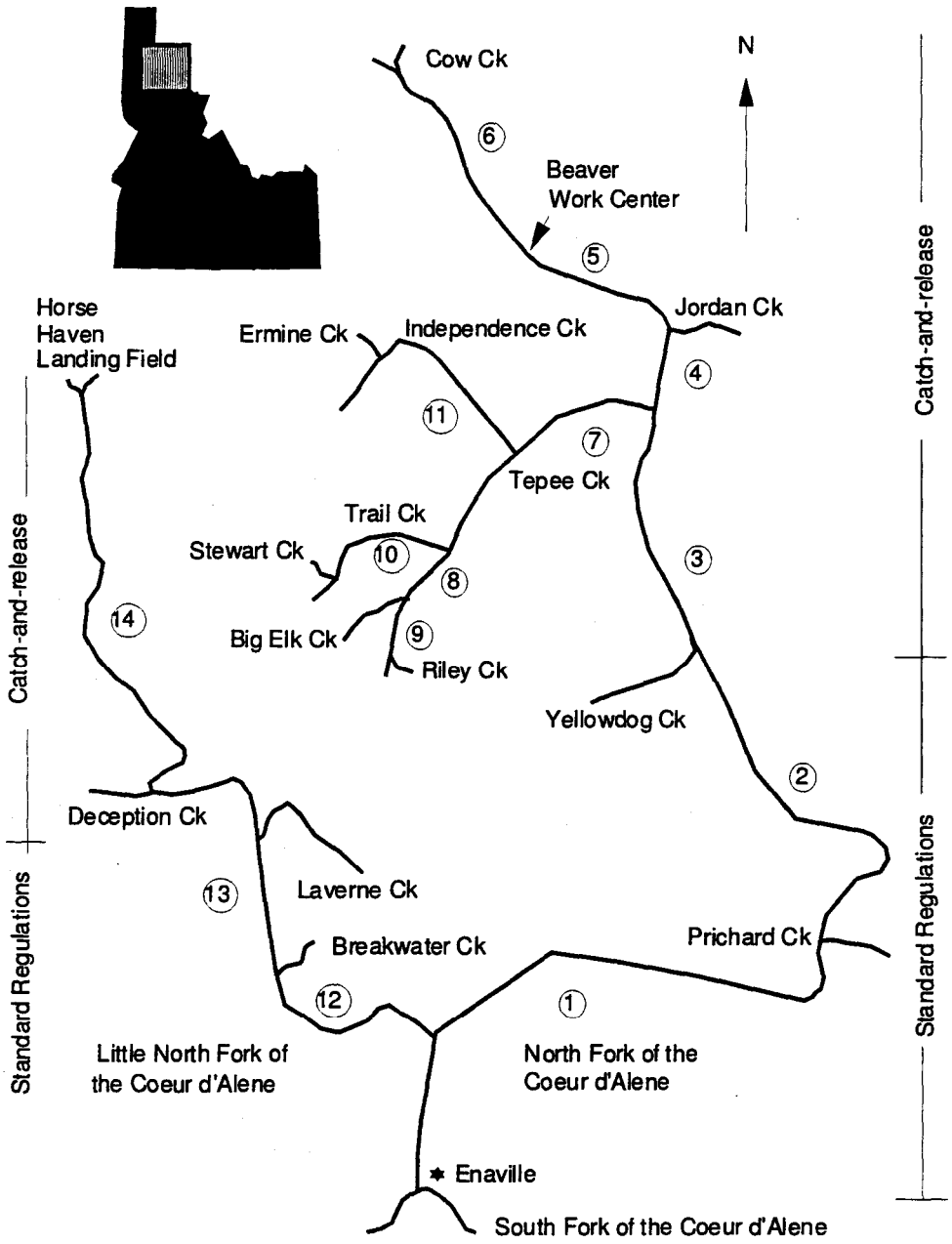

Figure 1. Location of the study area showing the angling regulation boundaries and numbered stratum.

mm size class increments from 50 to 300 mm. Larger fish were classified as longer than 300 mm. Salmonid fry measuring 50 mm or less were enumerated as age-0 salmonids. All other species of fish were counted but not classified into size classes. In addition to the transects counted in previous years (mostly pools), fish were also counted in several run, riffle, and pocketwater habitat types so we could estimate the number of fish in the streams.

Population Estimate

An estimate of the number of fish in the streams was made by determining the density of fish in each habitat type and the amount of habitat of each type in selected sections of the drainage. The study area was stratified into the following sections based on accessibility and the prevailing angling regulations (Figure 1), North Fork of the Coeur d'Alene River; (1) Enaville to Prichard Creek, (2) Prichard to Yellowdog creeks, (3) Yellowdog to Tepee creeks, (4) Tepee to Jordan creeks, (5) Jordan Creek to Beaver Work Center, (6) Beaver Work Center to Cow Creek; Tepee Creek drainage; (7) Tepee Creek from the mouth to the confluence of Trail Creek, (8)Trail to Big Elk creeks, (9) Big Elk to Riley creeks; (10) Trail Creek from the mouth upstream to Stewart Creek; (11) Independence Creek from the mouth upstream to Ermine Creek; Little North Fork of the Coeur d'Alene River; (12) from the mouth to Breakwater Creek, (13) Breakwater to Deception creeks, and (14) Deception Creek to Horse Haven landing field.

Habitat was classified at selected sites within each stratum by traveling on roads adjacent to study area streams, or by 100-pace survey in reaches where the streams were not visible or accessible from a road. The initial sampling site was randomly selected and subsequent sites were systematically selected every 0.1 miles when driving or every 100 paces when walking. The habitat type intersected by a visual transect line perpendicular to the stream bank at each sampling site was classified as a pool, run, riffle, or pocketwater habitat according to Hoelscher and Bjornn (1989) or as a chute. River widths were measured with a tape measure or a range-finder every 0.5 miles when driving or 500 paces when walking. The length of each strata was measured with a map wheel from 1:50,000 United States Geological Survey topographical maps.

Stream habitat type classifications were based on combinations of depth and water velocity: (1) runs - areas of intermediate depth and water velocity, (2) riffles - relatively shallow areas with high water velocity, often with surface turbulence caused by the substrate, (3) pools - areas typically deeper than runs with slow water velocity, (4) pocketwater - riffle areas interspersed with small pools caused by obstructions (usually large rocks) in the main stream channel (Hoelscher and Bjornn 1989). Habitat units were classified as pocketwater where more than 50% of the stream width was made up of small pools and riffles typical of pocketwater

areas in the North Fork of the Coeur d'Alene River from Enaville to Tepee Creek and the mouth of the Little North Fork upstream to Deception Creek. Habitat units in the North Fork upstream of Tepee Creek and Little North Fork from Deception Creek to Horse Haven landing field were identified as pocketwater where at least 25% of the stream width consisted of these types of habitat components. Chutes, a fifth habitat type were identified where water plunged a minimum of four inches (10 cm) across the stream width.

The proportion of each habitat type in a strata was calculated by dividing the number of transect lines classified as the habitat of interest by the total number of transects in the strata.

The surface area of a habitat type within a strata was calculated by:

$$A_{ht} - L_s * W_s * \%_{ht} \qquad \text{(Equation 1)}$$

Where: A_{ht} = Surface area of a habitat type in each strata.

L_s = Length of the strata (m).

W_s= Mean width of the strata (m).

$^{\%}$ht = Proportion of the habitat type of interest in the strata.

Densities of salmonids in pools were calculated from counts of fish in the established long-term transects, and a sufficient number of additional transects in riffle, run, pocketwater, and chute habitats to equal the number of pools snorkeled in each strata (Table 2).

Table 2. Length, mean width and density of cutthroat trout in each habitat type of each river section.

River Section	Length (m)	Mean Width (m)	Number of Transects	Habitat Type	Density (fish/100 m^2)
1	36,749	35.6	10	pool	0.33
			10	run	0.39
			9	riffle	0.03
2	22,176	33.4	8	pool	0.20
			8	run	0.43
			9	riffle	0.00
3	18,970	25.7	10	pool	2.09
			12	run	1.00
			9	riffle	0.02
4	8,744	20.2	11	pool	0.76
			9	run	0.22
5	12,419	15.3	7	pool	0.23
			7	run	0.15
6	7,096	7.4	13	pool	0.14
			9	run	0.52
7	12,545	14.6	13	pool	0.29
			16	run	0.13
			5	riffle	0.04
8	5,069	6.5	4	pool	0.19
			3	run	0.61
9	2,623	3.3	9	pool	0.53
10	9,124	6.9	13	pool	0.36
			8	run	0.07
11	10,644	11.5	5	pool	0.63
			5	run	0.33
			3	riffle	0.00
12	14,484	16.8	9	pool	0.04
			10	run	0.08
			8	riffle	0.00
13	16,981	18.2	11	pool	0.59
			11	run	0.17
14	12,735	11.1	8	pool	0.74
			8	run	0.00
			5	riffle	0.00

Mean densities of salmonids in the habitat of interest in each strata were calculated by:

$$MDsp(ht) = N_{sp}/SA_{ht} \quad \text{(Equation 2)}$$

Where: $MD_{sp(ht)=}$ Mean density of a species within the habitat of interest in each strata.

Nsp= Total number of a species counted in the habitat of interest in a strata.

SAht= Total surface area snorkeled in the habitat type of interest in a strata.

Estimated abundance of a species in a strata was calculated by:

$$Esp/s = MDsp(ht1)^{*A}(ht1) + {}^{MDs}P(^{ht2})^{*A}(^{ht2})$$

$$+ ...+Mdsp(htn)*A(htn) \quad \text{(Equation 3)}$$

Where: $E_{sp/s=}$ Estimated abundance of a species in a strata.

MDsp(ht)= Mean density of a species in the habitat of interest within each strata.

Population estimate of a species in the river was calculated by:

$$P\,E\,r\ {}^{E}s/s1 + {}^{E}s/s2 + \text{'''} + Es/sn \quad \text{(Equation 4)}$$

Where: P E r Population estimate of a species within the river.

Es/sn= Estimated abundance of a species from each strata.

We tried to select similar reaches from the respective drainages when comparing cutthroat trout population estimates and distributions between rivers.

Distance from headwaters, mean width, and prevailing angling regulations were the criteria used to determine similarity.

Results

Abundance

In 1973, the first year of a reduction in the creel limit from 15 to 10 fish (Table 1), an average of 4.8 westslope cutthroat trout were counted per transect throughout the study area. Despite subsequent restrictions in the angling limit an average of 4.1 fish were observed throughout the study area in 1980, 4.8 during 1981 and 6.0 in 1991 (Figure 2).

In 1973, a mean of 5.6 cutthroat trout per transect were counted in the Little North Fork of the Coeur d'Alene River (river sections 12-14; Figure 2). An average of 5.9 fish were counted in 1980 and 7.5 during 1981 (special angling regulations applied), but only 3.9 in 1991 (catch-and-release since 1988).

In the North Fork of the Coeur d'Alene River, an average of 4.6 cutthroat trout were counted per transect in 1973, 3.2 during 1980, 3.4 in 1981 and 7.0 in 1991 (river sections 1-7; Figure 2). In river sections one and two (limited harvest allowed), an average of 2.4 cutthroat trout were counted in 1973 (10 fish creel-limit), 0.5 and 0.9 in 1980 and 1981, respectively, (two cutthroat trout over 16" creel-limit), and increased to 7.5 in 1991 (one cutthroat trout over 14"). In the reach with special regulations (river section three, Yellowdog to Tepee creeks), an average of 11.2 fish were counted in 1973, 6.8 in 1980, 5.7 during 1981 (limited harvest regulations applied) and increased to 28.4 in 1991 (catch-and-release since 1985). An average 6.0 cutthroat trout were counted in transects between Tepee and Cow creeks in 1973 (river sections four, five and six), 5.8 in 1980, 5.4 during 1981 but only 1.1 in 1991. No cutthroat trout were observed in the transects in Tepee Creek during 1973, an average of 1.3 were counted in 1980, 3.8 during 1981 and 2.8 in 1991. There were no long-term transects established in the tributaries of Tepee Creek (river sections 8-11).

Rainbow trout have been observed primarily in the downstream halves of both the Little North Fork and North Fork drainages since 1973 (Figure 3). Virtually all of the rainbow trout observed in the study area during 1991 were of hatchery origin. Lewynsky (1986) classified 15% of all the rainbow trout he observed as wild fish. The abundance and distribution of hatchery-reared rainbow trout observed while snorkeling in 1991 may have been determined by how many fish were stocked and how close to the stocking date the count occurred.

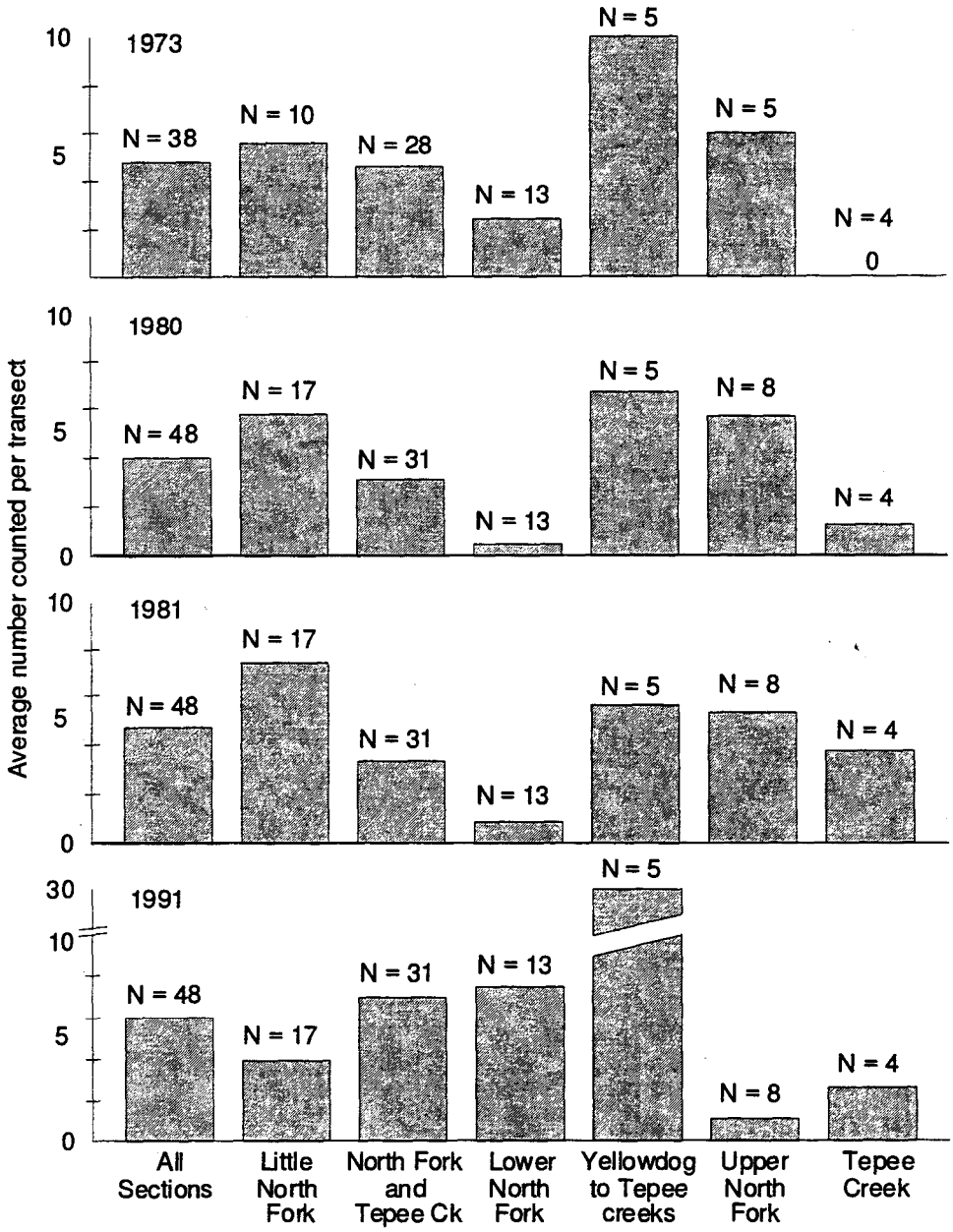

Figure 2. Number of transects counted and the average number of cutthroat trout counted per transect in various reaches of the study area each year surveyed.

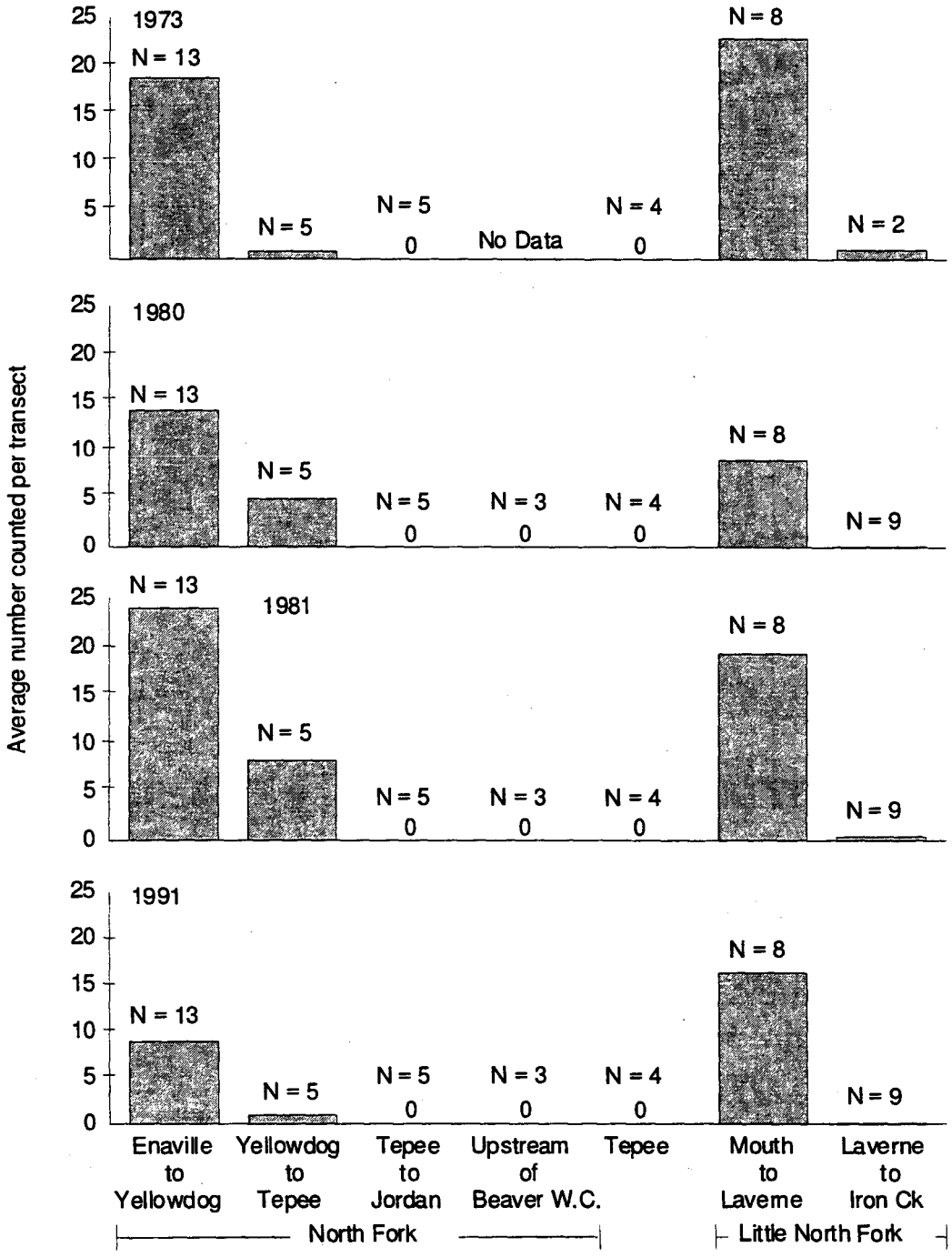

Figure 3. Rainbow trout densities in the North Fork and Little North Fork of the Coeur d'Alene rivers and Tepee Creek each year surveyed.

Size Classes

The proportion of cutthroat trout shorter than 150 mm counted throughout the study area has ranged between 8% and 15% in the years surveyed (Figure 4). Approximately 86% of the fish counted in 1973 were between 150-299 mm long, 53.3% in 1980, 65.4% during 1981 and 74.3% in 1991. Only 6% of the fish observed in 1973 were longer than 300 mm, 37.2% in 1980, 19.9% during 1981 and 16.9% in 1991.

Cutthroat trout smaller than 150 mm have made up less than 10% of all the fish counted in the North Fork between Yellowdog and Tepee creeks (river section three) each year fish were counted (Figure 4). Between 85% and 89% were between 150 and 299 mm in length during 1973, 1981 and 1991 but only 56.1% were in this size class in 1980. In 1973, 6% of the fish were larger than 300 mm, 39% in 1980, 14.7% during 1981 and declined further to 11.3% in 1991.

In the reach of the Little North Fork with catch-and-release regulations (river section 14), the percentage of all cutthroat trout counted that were smaller than 150 mm has increased from 14.6 in 1980 to 26.6 during 1981 and to 45.5 in 1991 (Figure 4). Fish from 150-299 mm long have ranged between 53% and 64.5% of all fish counted. The proportion of fish 300 mm and longer has decreased each year surveyed from 32.3% in 1980 to 8.9 in 1981 and to 1.8% in 1991.

Population Estimate

We estimated that there were 13,005 (68/km) westslope cutthroat trout in the North Fork and Little North Fork of the Coeur d'Alene rivers and the Tepee Creek drainage during August 1991 (Figure 5). Of the 13,005 fish, 87% were in the North Fork of the Coeur d'Alene River, and 6.5% each in the Little North Fork and Tepee Creek drainages.

We estimated 108 cutthroat trout/km in the lower North Fork (river sections one and two) (Table 3). When compared to similar reaches with regulations that allow harvest in other rivers, the North Fork density estimate is 44% higher than that for the St. Joe River (same angling regulations in effect since 1988); 4.7 times greater than the estimate for the Little North Fork of the Coeur d'Alene River and about nine times more than estimates in reaches of the Lochsa (six fish limit, only two over 16"; implemented in 1977) and North Fork of the Clearwater (three fish limit, no size limit; implemented in 1972) rivers.

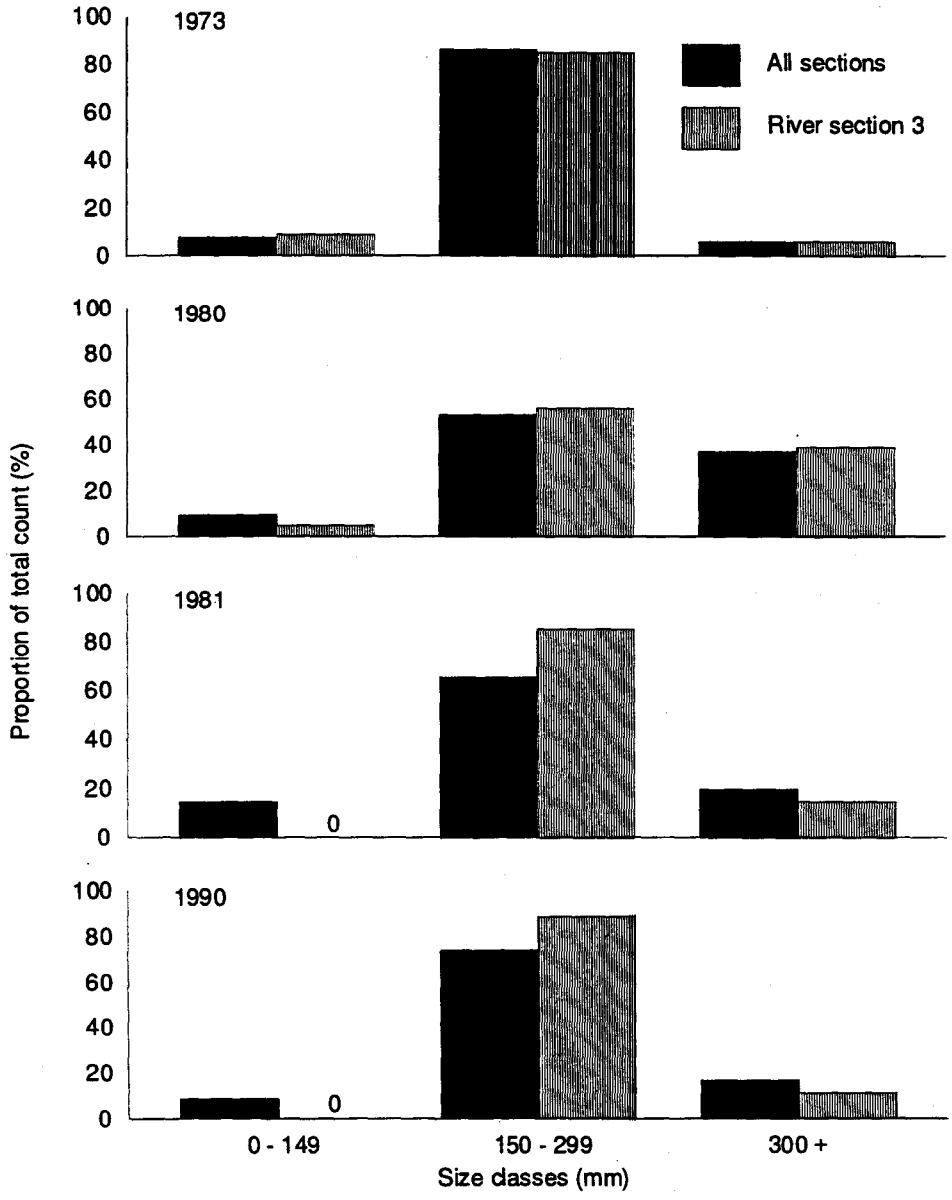

Figure 4. Proportion of cutthroat trout classified into 149 mm size classes in all sections combined, and river section three each year surveyed.

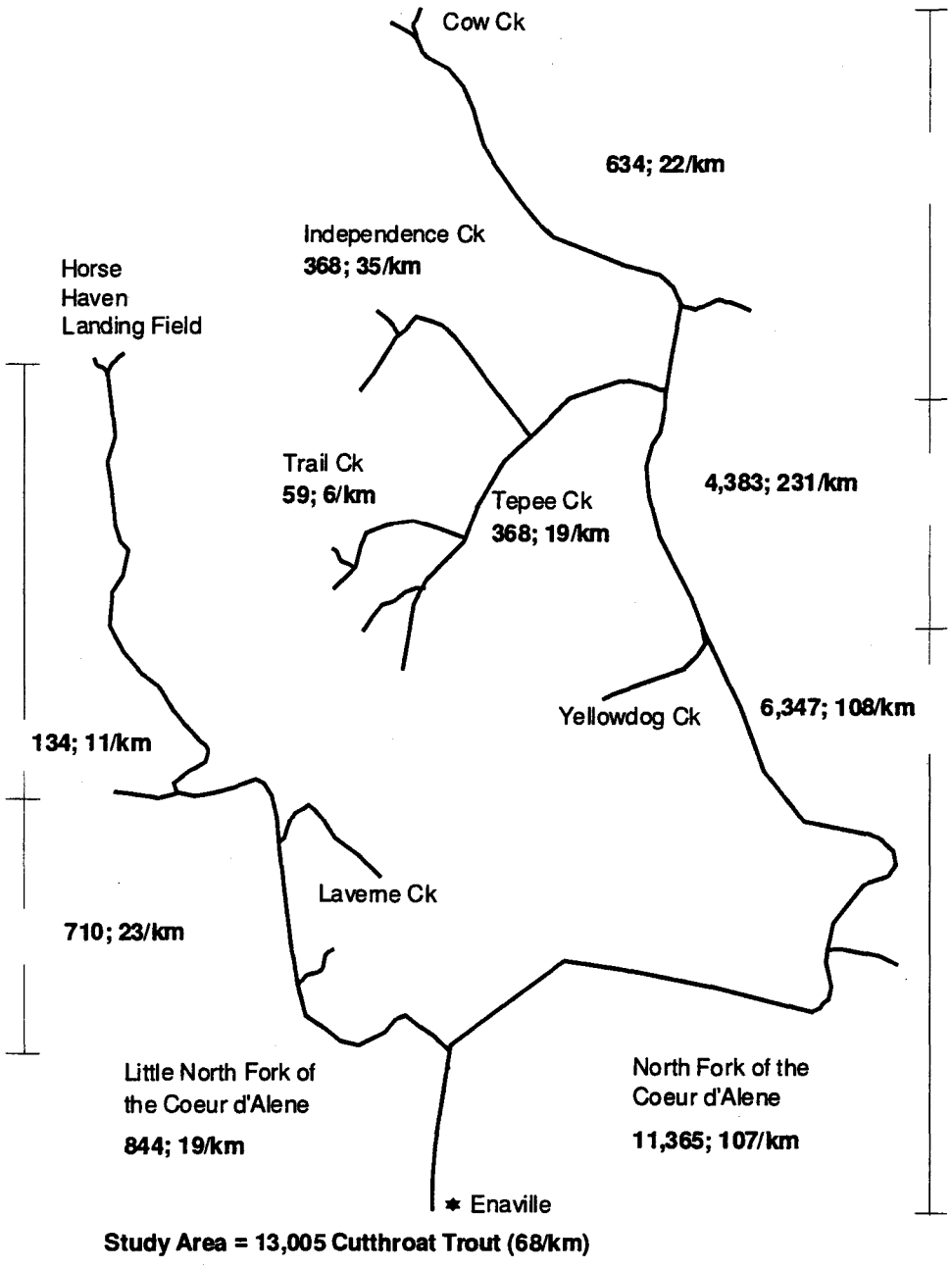

Figure 5. Cutthroat trout population estimates in the North Fork and Little North Fork of the Coeur d'Alene rivers and the Tepee Creek drainage.

Table 3. Estimated abundance and density of westslope cutthroat trout in similar reaches of the Little North Fork and North Fork of the Coeur d'Alene (1991), Lochsa, St. Joe and North Fork of the Clearwater drainages (1990) with catch-and-release regulations (no harvest allowed) and in reaches with regulations that allowed harvest.

	Abundance and density estimates		
	Harvest	No harvest allowed	
River	allowed	Lower section	Upper section
North Fork Coeur d'Alene[1]	6,347 108/km	4,383[a] 231 /km	634[b] 22/km
Little N.F. Coeur d'Alene[1]	433 30/km	277[c] 38/km	134[d] 11/km
St. Joe[1]	4,391[e] 75/km	5,233[f] 218/km	4,413[g] 345/km
Lochsa[2]	644[h] 15/km	5,415[i] 175/km	5,310[j] 151 /km
North Fork Clearwater[3]	1,193[k] 12/km	1,150[l] 70/km	1,529[m] 178/km

Angling regulations.

[1] only one cutthroat trout,14" minimum; and catch-and-release implemented 1988.

[2] six fish, only two over 16"; and catch-and-release started in 1977.

[3] three cutthroat trout, no size limit since 1972; catch-and-release since 1970.

[a] Yellowdog to Tepee creeks

[b] Tepee to Cow creeks

[c] Laverne to Deception creeks

[d] Deception Creek to Horse Haven landing field

[e] Calder to Prospector Creek

[f] Prospector to Gold creeks

[9] Spruce Tree Campground to Ruby Creek

[h] Pete King to Boulder creeks

[i] Boulder to Weir creeks

[j] Weir Creek to Powell

[k] Isabella to Kelly creeks

[l] Kelly Creek; mouth to Moose Creek

[m] Moose to Box creeks

We estimated there were 231 cutthroat trout/km in the lower end of the reach of the North Fork of the Coeur d'Alene River with regulations prohibiting harvest (Yellowdog to Tepee creeks) (Table 3). Similar densities were found in the lower ends of reaches of the St. Joe and Lochsa rivers with regulations not allowing harvest, but the North Fork of the Coeur d'Alene River densities were 3.3 times greater than estimates for lower Kelly Creek and six times greater than that for the Little North Fork of the Coeur d'Alene River. In the upper reach of the North Fork with catch-and-release regulations (Tepee to Cow creeks), the density was 22 cutthroat trout/km, twice that for the analogous reach in the Little North Fork, but only 6.4% of that for a similar reach of the St. Joe River, 14.6% of the estimated density for the upper Lochsa River, and only 12.4% of that for upper Kelly Creek.

Cutthroat trout density estimates in upper reaches of the St. Joe River and Kelly Creek with catch-and-release regulations were 1.5 and 2.5 times greater, respectively, than those for lower reaches (Table 3). However, density estimates for the upper reaches of the Little North Fork and North Fork Coeur d'Alene rivers were only 29% and 9.5% of those for the lower reaches (river section three), respectively.

Habitat

Runs were the predominant habitat type in most reaches of the study area ranging between 42% and 70% (Table 4). However, riffles occurred slightly more frequently than runs in the North Fork from Tepee Creek to Beaver Work Center (sections four and five, Figure 1; Table 4). Generally, runs were followed in descending order by riffles (range = 13-49%), pools (range = 9-32%), and chutes (range = 0-4%). Although pocketwater was one of the habitat types considered for this study, there was none observed in the study area.

In the North Fork, the percentage of pool habitat ranged from 9-18% (Table 4). Riffles ranged between 17-28% and runs from 61-70% in the section downstream of Tepee Creek (sections 1-3) but upstream of Tepee Creek (sections 4-6) riffles were from 37-49% and runs approximately 42% of the habitat. Pool-to-riffle ratios were less than 1:1 throughout the North Fork but were generally higher downstream of Tepee Creek than upstream. The lowest pool-to-riffle ratio observed in the study area (0.2:1) was in the reach from Jordan Creek to Beaver Work Center (river section five).

In the Tepee Creek drainage (river sections 7-11), pools made up 13.5% to 32% of the habitat surveyed (Table 4). Pool-to-riffle ratios were between 0.5-0.7:1 with the exception of Tepee Creek upstream of Big Elk Creek where a ratio of 2.5:1 was observed. Runs occurred 1.5-4.5 times more frequently than riffles throughout the Tepee Creek drainage.

Table 4. Total length and percentage of habitat types in each river section of the study area.

River section	Length (km)	Percent habitat type			
		Pool	Riffle	Run	Chute
1	36.7	13.1	16.7	70.2	0.0
2	22.2	8.7	27.8	63.5	0.0
3	19.0	13.6	25.0	60.9	0.5
4	8.7	14.2	43.2	41.9	0.9
5	12.4	8.9	48.6	41.8	0.6
6	7.1	17.6	37.0	41.8	3.9
7	12.5	13.5	27.0	59.4	0.0
8	5.1	20.0	29.3	50.7	0.0
9	2.6	31.7	12.7	55.6	0.0
10	9.1	17.4	34.2	48.5	0.0
11	10.6	17.1	25.3	57.5	0.0
12	14.5	22.3	19.8	57.9	0.0
13	17.0	9.2	31.4	59.5	0.0
14	12.7	12.7	24.8	62.5	0.0

In the Little North Fork, the frequency of pool habitat between Breakwater Creek and Horse Haven landing field (river sections 13 and 14) was about half of what it was downstream of Breakwater Creek (Table 4). The pool-to-riffle ratio was 1.1:1 downstream of Breakwater Creek and 0.3-0.5:1 upstream. Runs occurred 2-3 times more frequently than riffles did throughout the Little North Fork.

There was a preponderance of run habitat in roaded sections of similar reaches of the Lochsa, St. Joe, Kelly Creek, North Fork and Little North Fork of the Coeur d'Alene rivers, however, similar reaches in the St. Joe and Kelly Creek had more equal proportions of habitat types (Table 5). Runs were followed in declining order by riffles and pools. A small proportion of pocketwater was observed in the Lochsa and St. Joe rivers, and in Kelly Creek.

Table 5. Cutthroat trout densities by habitat types in roaded and unroaded sections in the Lochsa and St. Joe rivers, Kelly Creek, North Fork and Little North Fork of the Coeur d'Alene rivers with catch-and-release (no harvest allowed) regulations.

	Lochsa	St. Joe	Kelly Creek	North Fork	L.North Fork
Roaded Sections					
Length (m)	35,200[a]	24,000[b]	16,960[c]	18,970[d]	20,047[e]
			Percent habitat type		
Pool	6.90	30.00	32.70	13.60	11.00
Run	52.50	34.70	27.10	61.40	61.00
Riffle	39.10	33.50	36.40	25.00	28.00
Pocketwater	1.50	1.80	3.70	0.00	0.00
			Cutthroat Trout density (fish / 100 m)		
Pool	1.54	1.12	1.12	2.09	0.82
Run	0.55	1.67	0.37	1.00	0.09
Riffle	0.00	0.29	0.06	0.00	0.04
Pocketwater	0.10	1.07	0.98	0.00	0.00
Weighted density	0.40	1.03	0.52	0.90	0.16
Walk-in Sections					
Length (m)		12,800[f]	8,640[g]	8,744[h]	
			Percent habitat type		
Pool		9.20	25.00	14.20	
Run		45.00	31.80	41.90	
Riffle		45.80	43.20	43.90	
			Cutthroat Trout density (fish / 100 m)		
Pool		6.12	1.30	0.76	
Run		2.03	1.94	0.22	
Riffle		0.00	0.00	0.00	
Weighted density		1.48	0.94	0.20	

[a]Boulder to Weir creeks
[b]Prospector to Gold creeks
°Mouth to Moose Creek
[d]Yellowdog to Tepee creeks
[e]Deception Creek to Horse Haven landing field spruce Tree campground to Ruby Creek
[g]Moose to Box creeks
[h]Tepee to Jordan creeks

In the roaded sections of the five streams we compared, cutthroat trout densities were generally highest in pools followed by runs, pocketwater and riffles (Table 5). Fish densities in pools were highest in the North Fork and lowest in the Little North Fork. Densities in runs along roaded sections of the Little North Fork were much lower when compared to runs in similar reaches of the other rivers. Weighted densities (by percent of habitat type in section) were greatest in the St. Joe and North Fork drainages and lowest in the Little North Fork.

The proportion of pools was similar in both the roaded and walk-in (unroaded) sections of the North Fork, but runs were 19.5% lower and riffles 19% higher in the walk-in section as compared to the roaded section (Table 5). There were 20% less pools in the walk-in section of the St. Joe River as compared to the roaded section, but the proportion of runs and riffles remained equal.

In the St. Joe River and Kelly Creek, fish densities increased from 16-546% in respective habitat types of the walk-in sections as compared to roaded sections (Table 5). Whereas fish densities in the respective habitat types in the roaded sections of the North Fork were 64-78% lower than in the unroaded sections. Similarly, weighted densities in the walk-in sections of the St. Joe River and Kelly Creek drainages increased 44% and 81 %, respectively, from those in the roaded sections, however, the weighted density in the walk-in section of the North Fork was 78% lower than in the roaded section.

Discussion

The implementation of restrictive angling regulations has coincided with an increased abundance of westslope cutthroat trout in the North Fork of the Coeur d'Alene River downstream of Tepee Creek as evidenced by the increased numbers of fish counted per transect each year surveyed since 1980. It is possible that the one cutthroat trout, 14" minimum length creel-limit is sufficiently restrictive to result in an increased abundance of cutthroat trout in the North Fork Coeur d'Alene and St. Joe rivers. However, the restrictive limit has not resulted in increased fish abundance in the Little North Fork of the Coeur d'Alene River downstream of Laverne Creek. Less restrictive harvest regulations for the lower Lochsa and North Fork of the Clearwater rivers may be the reason for lower fish densities in these reaches. Cutthroat trout abundance and numbers of larger fish have decreased in all other reaches of the North Fork of the Coeur d'Alene River drainage since 1980. Abundance and numbers of fish in all size classes increased in Kelly Creek and the upper St. Joe River within the first three years following the implementation of restrictive angling regulations (Johnson and Bjornn 1978).

Higher densities of cutthroat trout were observed in downstream, roaded reaches than in upstream, unroaded reaches of the North Fork of the Coeur d'Alene River and upstream reaches of the Little North Fork drainages, which is incongruous with what has been observed in the St. Joe and Lochsa rivers, and Kelly Creek. In the latter streams, densities of cutthroat trout were higher in the upper reaches of each drainage in August than in the lower reaches. The distribution of fish within a drainage can be influenced by habitat quality and quantity, including temperatures.

Cutthroat trout usually do not remain in waters where maximum temperatures consistently exceed 22 °C, although they may be able to withstand brief periods of water temperatures as high as 26 °C if considerable cooling occurs at night (Behnke and Zarn 1976). In the streams being discussed, cutthroat trout move upstream during the summer as water temperatures increase, with the extent of movement related to the amount of warming of the rivers. Downstream reaches of the St. Joe and Lochsa rivers, and Kelly Creek cooled less at night than upstream reaches and accumulated more thermal units than upstream reaches by August 1989 and 1990 (Hunt 1992). Concurrently, cutthroat trout densities were lowest in the warmer, downstream reaches and highest in the cooler, upstream reaches. Water temperatures were not continuously monitored with automated recorders in the North Fork and Little North Fork of the Coeur d'Alene rivers during 1991. Water temperatures recorded daily with a handheld thermometer indicate temperatures were at least as warm as those recorded in the Lochsa and St. Joe rivers and Kelly Creek drainages suggesting cutthroat trout should be occupying the cooler, upstream reaches of the North Fork and Little North Fork of the Coeur d'Alene river drainages, if temperatures were a factor influencing their distribution.

Long-term data on quantity and quality of habitat in the North Fork and Little North Fork rivers was not available for comparison with the long-term fish-data. The proportions of pool and run habitat types in the reach of the North Fork between Tepee and Cow creeks and in Trail Creek were lower than in drainages without roads and extensively logged areas. Upper reaches of the Little North Fork have between one-half and one-third the pools, and slightly more runs, than Independence Creek, but the cause of the differences has not been determined. Quantification of habitat parameters indicative of quantity and quality of available habitat may help resolve lingering questions regarding the role of habitat in abundance changes and distribution of cutthroat trout in the North Fork and Little North Fork of the Coeur d'Alene river drainages.

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